DNM 400 Ⅱ / 500 Ⅱ / 650 Ⅱ

High Productivity Vertical Machining Center

Doosan Machine Tools

Optimal Solutions for the Future

High Productivity, High Efficiency
Vertical Machining Center

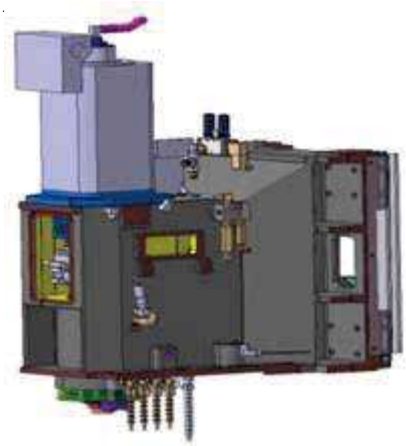
DNM Ⅱ series are available with a diversity of spindle specifications to meet various requirements.
Roller LM guide enhances rigidity and extends service life. Utmost accuracy is achieved
with direct coupled spindle structure and standard thermal displacement error compensation.
The operator panel is redesigned to improve operator convenience.

DNM400Ⅱ/500Ⅱ/650Ⅱ

Features

High Reliability Spindle & High Precision opt.

- 12000 r/min direct coupled spindle provides high cutting capacity and minimizes noise and vibration.
- Utmost precision cutting is realized with thermal displacement compensation as standard



2 Durability

- Ball-type is replaced with roller-type LM Guide as standard to improve rigidity and long-term durability.

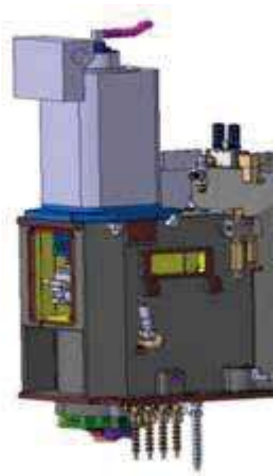
3 Improved Usability

- The operator panel is redesigned to make operating more convenient

High Reliability Spindle & High Precision

High rigidity spindle provides stable accuracy in long, heavy duty and high speed cutting.

Spindle Head



Spindle Max. Speed

8000 r/min std.
(Belt)

12000 r/min opt.
(Direct-coupled)

12000 r/min direct-coupled spindle (option) minimises noise and vibration and reduces spindle start/stop time.

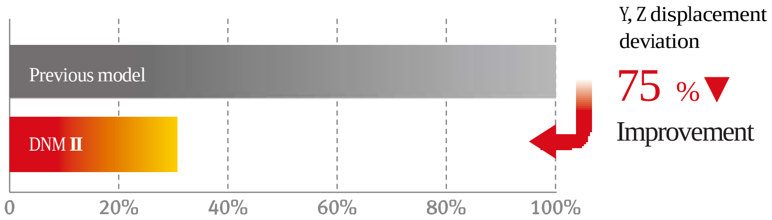
2-Face Locking Tool System (BIG PLUS) std.

The 2-face locking tool system offers longer tool life, higher power and more precise machining by the dual contact to both of the spindle surface and tool holder flange surface, as well as both the spindle taper and tool holder taper shank.

Improvements by Adopting Direct Spindle

Thermal error has been reduced by replacing 12000 r/min belt-type spindle with 12000 r/min direct-coupled spindle.

✻ Only DNM 500 / 650 Ⅱ : 12000 r/min
(Doosan factory's measuring condition)



* DNM 650, 12000 r/min (Doosan factory's measuring condition)

Drain Catcher std.

Removes moisture in the compressed air in solenoid valves and cylinders to extend service life of the pneumatic system.

Spindle Head Cooling System opt.

Option for 8000 r/min, standard for 12000 r/min

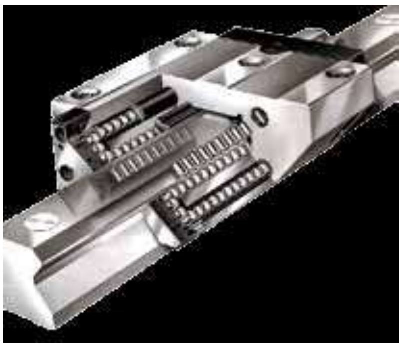
Spindle Head Cooling System is offered for long, continuous operation. The system circulates cooled oil around spindle bearing to prevent thermal displacement and guarantee high accuracy cutting.

Durability

Main structures including bed and column are designed at optimum conditions for high speed and heavy duty cutting.

High Rigidity Roller Type LM Guide

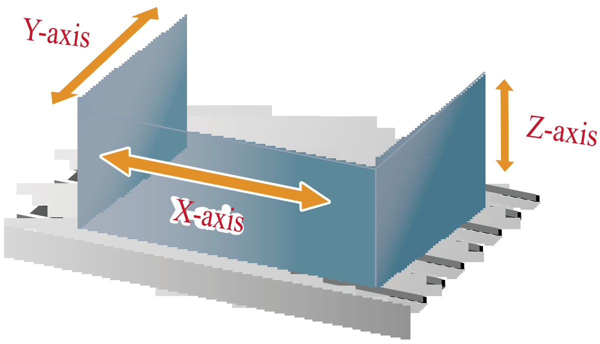
Ball type LM Guide is replaced with roller type LM Guide to improve cutting performance and surface roughness. Service life is also extended to more than double compared to ball type LM Guide.



nd feedrates are
l with roller type
e and coupling.

Wide Cutting Area

Various shapes can be processed



		DNM 400 II	DNM 500 II	DNM 650 II
X-axis	mm (inch)	762 (30.0)	1020 (40.2)	1270 (50.0)
Y-axis	mm (inch)	435 (17.1)	540 (21.3)	670 (26.4)
Z-axis	mm (inch)	510 (20.1)	510 (20.1)	625 (24.6)

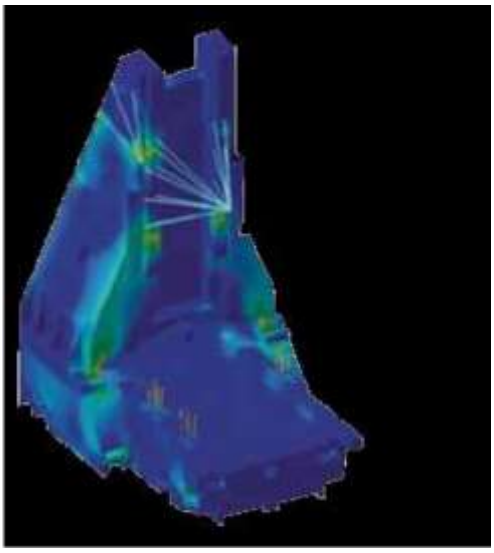
* DNM 650 Ⅱ core machine

Static Rigidity

The highly rigid body raises the static stiffness by 30% compared to the previous model.

Dynamic Rigidity

Frequency response and vibration attenuation performances have been improved – high frequency increased by 35 % than the previous models.



* Designed with FEM (Finite Element Method) to implement stable machine structure.

Improved Usability

Easy Operation Package

Doosan's easy operation software package is customized to provide fast and easy operation for tooling, workpiece and program setup. These features maximize productivity by minimizing time lost during process setup.

Data Registry Table

Provides tool information for POT in 2D graphics

ATC Recovery Help

Guides the operator for troubleshooting in case of emergency stop of abnormal operation of ATC

G Code List

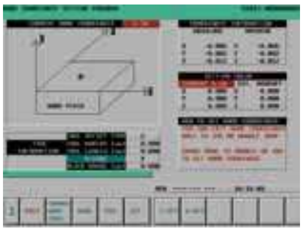
Explanation/help topics for G-Code can be viewed on the screen

Sensor Status Monitor

Provides view of the operation of the standard sensors and solenoid valves of the machine.

Table Moving for Setup

Table can be moved to workpiece set-up position with simple key strokes.



Easy work coordinate setting

A separate screen for viewing customizable parameters

M Code List

Explanation/help topics for M-Code can be viewed on the screen

Tool Load Monitor opt.

Damage to tools is minimized by monitoring the axis and spindle load during cutting operations.

Easy-to-use Operator Panel

The operator panel is integrated for convinient usage. Additional, customized function switches can be attached to maximize operator convenience.

USB Port

Upload/download of NC software programs, NC parameters, tool information and ladder program using USB drive is allowed but, DNC operation is not supported.

Fixture clamp/unclamp button counter, timer or special option buttons can be placed on the panel.

Partitions are placed between all buttons to prevent pushing an unintended button.

Swivelling operating console

The operation panel can be rotated by up to 90 degrees for convenient operator position. The control provides a wide selection of detailed alarm messages which makes fault-finding easier for better usability.

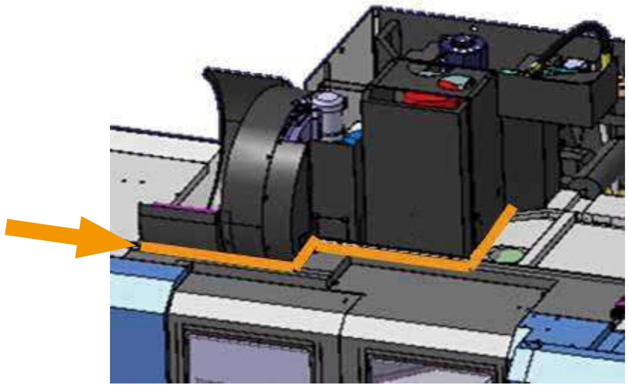
Portable MPG

The portable MPG allows you to set a workpiece more easily.

Operator-Friendly Design

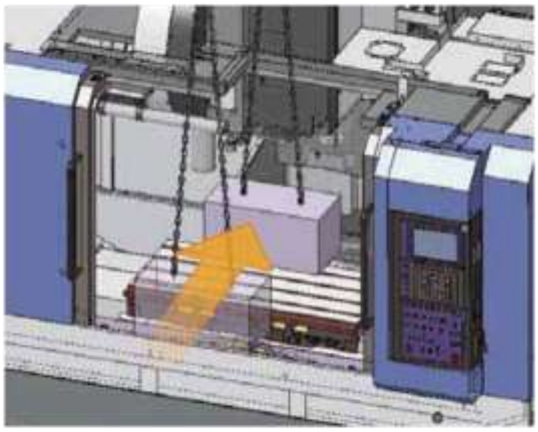
Built-in Chip Brush

A brush is provided between the top cover and spindle head to remove chips and coolant from the spindle head.



Top Cover Opening

The top cover on the machine can be opened to allow crane to access the table when working with a heavy workpiece.

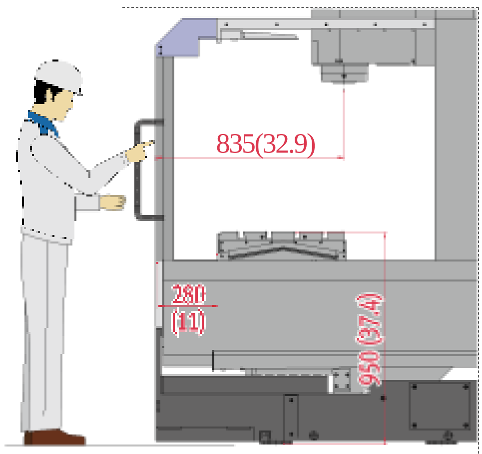


Excellent Accessibility

Enhanced operator's accessibility to machine facilitates mounting of workpieces.

DNM 500 II

Unit : mm(inch)



High Productivity

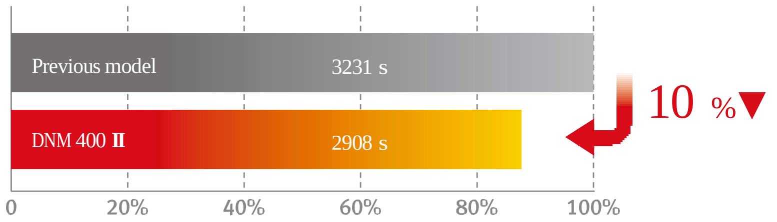
Spindle acceleration/deceleration and cutting rate are further increased.

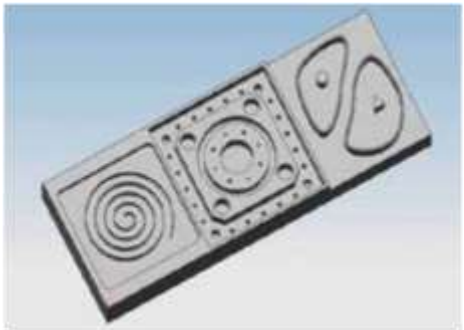
Reduced Cycle Time

-4 %

Cycle time is reduced by more than 10% compared to the previous model.

Unit : second

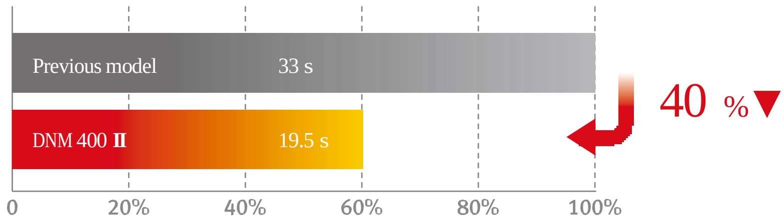




＊ Based on the productivity specimen of DOOSAN using 18 tools including tap and milling.

Reduced Tapping Cycle Time

Unit : second

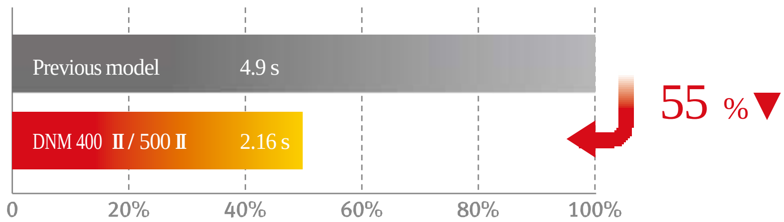


＊ 10-M3x0.5

Tapping Cycle time is reduced by 40% compared to the previous models.

Reduced Spindle Acceleration/Deceleration Time

Unit : second



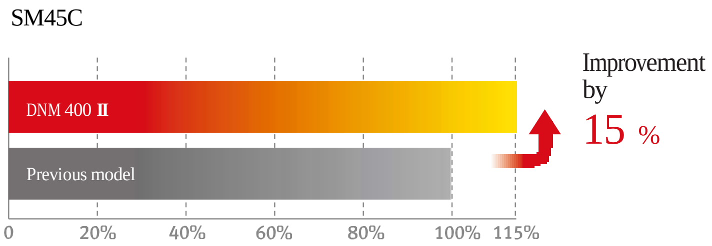
Spindle acceleration/deceleration is reduced by 55% from the previous model.

＊ 12K, 12000 r/min motor

※ The data above is based on DOOSAN's test standards, and may vary by testing conditions.

Higher Cutting Power

Face Milling (max. chip removal capacity)



Higher cutting power is implemented with higher motor power and torque of the spindle motor

	Previous Model	DNM II
Max. spindle motor power	15 kW (20.1 Hp)	18.5 kW (24.8 Hp)
Max. spindle torque	106 N·m (78.2 ft-lb)	117 N·m (86.3 ft-lb)

Tool Magazine

Productivity increase with the CAM-type tool changer (standard) that supports faster tool changing.

Tool-to-Tool

1.3 s

Tool storage capacity

30 tools

40 tools opt.

Rapid Traverse

Linear motion guide ways and high speed servomotors apply high rapid axis movement. This reduces non-cutting time and machining time for greater productivity.

	Rapid traverse
X-axis m/min (ipm)	36 (1417.3)
Y-axis m/min (ipm)	36 (1417.3)
Z-axis m/min (ipm)	30 (1181.1)

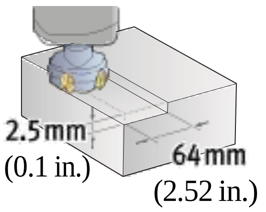
Machining Capacity

Provides high-productivity and high-accuracy in a variety of machining operations

Face mill

Carbon steel (SM45C)

• ø80mm (3.15 in.) Face mill (6Z)



Machining rate
432 cm³/min (26.4 in³/min)

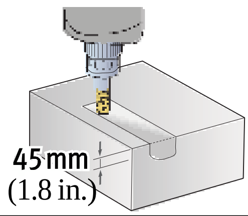
Spindle speed
1500 r/min

Feedrate
2700 mm/min (106.3 ipm)

End mill

Carbon steel (SM45C)

• ø30mm (1.2 in.) Endmill (6Z)



Machining rate
81 cm³/min (5.0 in³/min)

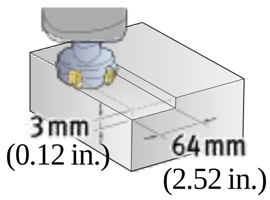
Spindle speed
222 r/min

Feedrate
84 mm/min (3.3 ipm)

Face mill

Gray casting (GC25)

• ø80mm (3.15 in.) Face mill (6Z)



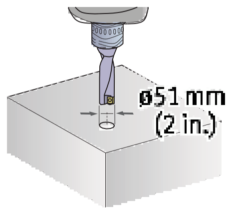
Machining rate
691 cm³/min (42.2 in³/min)

Spindle speed
1500 r/min

Feedrate
3600 mm/min (141.7 ipm)

U-drill

Carbon steel (SM45C)



Machining rate
172 cm³/min (10.5 in³/min)

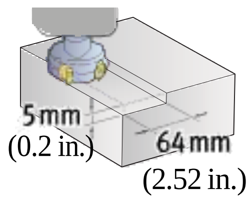
Spindle speed
750 r/min

Feedrate
84 mm/min (3.3 ipm)

Face mill

Aluminum (AL6061)

• ø80mm (3.15 in.) Face mill (6Z)



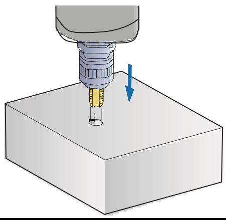
Machining rate
1785 cm³/min (109 in³/min)

Spindle speed
1500 r/min

Feedrate
5580 mm/min (219.7 ipm)

Tap

Carbon steel (SM45C)



Machining rate
M30 X P3.5

Spindle speed
212 r/min

Feedrate
742 mm/min (29.2 ipm)

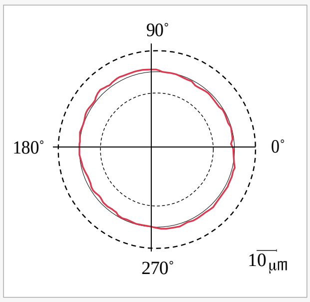
• The results, indicated in this catalogue are provides as example. They may not be obtained due to differences in cutting conditions and environmental conditions during measurement.

Machining Accuracy

For increased repeatability and reliability

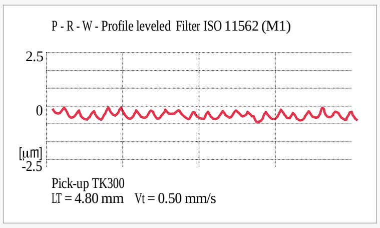
Designed for exceptional high accuracy and minimized thermal displacement and vibration.

Roundness



• Model : DNM 500
• Material : A7075F
• Tool : Endmill ø16mm
(ø0.6 in.)
(4 blades)

Roughness



Ra 0.12 µm

• Spindle speed : 8000 r/min
• Feedrate : 1000 mm/min
(39.4 ipm)

• The results, indicated in this catalogue are provides as example. They may not be obtained due to differences in cutting conditions and environmental conditions during measurement.

Easy-to-Use Chip Conveyor

Removing chips is very important in terms of productivity and environmental protection. achieve these goals, the DNM Ⅱ series provide various chip handling systems for better work environment.

Chip Removal

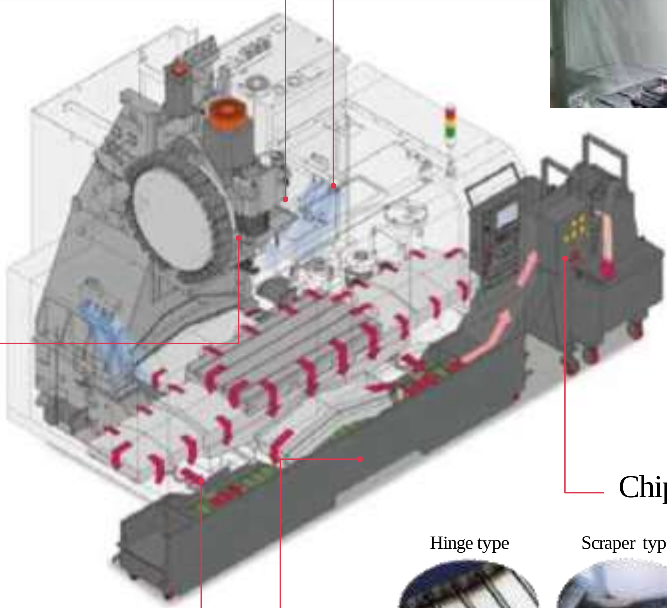
Easy chip removal design

Chip and coolant are collected from both sides of the table in the chip pan in front of the machine, and discharged by chip conveyor. Left or right hand chip conveyor discharge is available.

Increased flood coolant capacity

Chip handling capacity is improved with a high flood wash pump.

Shower Coolant opt.



Through-Spindle Coolant System opt.

Middle pressure : 1.96 Mpa (284.2 psi)
High pressure : 6.86 Mpa (994.7 psi)

Chip Conveyor opt.

Hinge type | Scraper type | Drum filter type

Screw Conveyor*

Internal screw conveyor at left and right sides (standard).

* Please select the chip conveyor considering the material of the workpiece. Consult with sales man for details.

Large capacity coolant tank with chip pan and box filter

Coolant tank capacity
DNM 400 Ⅱ : 300L
DNM 500 Ⅱ : 360L
DNM 650 Ⅱ : 380L

Easy to discard chips piled up

Optional Equipment

A wide range of options are offered for higher efficiency and convenience of the customers.

4-axis Auxiliary Devices Interface

※ Recommended Rotary Table : ø250(DNM 400 Ⅱ /DNM 500 Ⅱ), ø320(DNM 650 Ⅱ)

※ Please check the driving system (hydraulic or pneumatic) of the rotary table before ordering the machine

Hydraulic/Pneumatic Fixture Line

Fixture check list (for hydraulic / pneumatic fixtures)

● Pressure source

Hydraulic	□ P/T	□ A/B
Pneumatic	□ P/T	□ A/B

● Number of ports

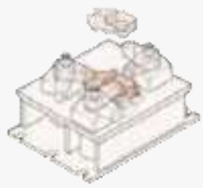
□ 1pair (2-PT 3/8"port)
□ 2pair (4-PT 3/8"port)
□ 3pair (6-PT 3/8"port)

● Hydraulic power unit

Supply scope : □ User □ DOOSAN
(Please check the below detail specification, if you want Doosan to supply.)

□ Use Doosan standard unit
24 L/min (6.3 gal/min) /
4.9 MPa (711 psi)

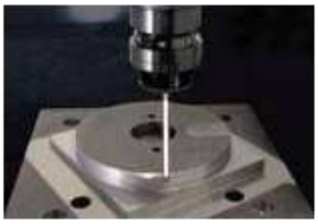
□ Special requirement
_______L / min (gal/min) at _______MPa (psi)



※ Contact Doosan for more information

Automatic tool measurement

Automatic workpiece measurement



Minimum Quantity Lublication

Misting device

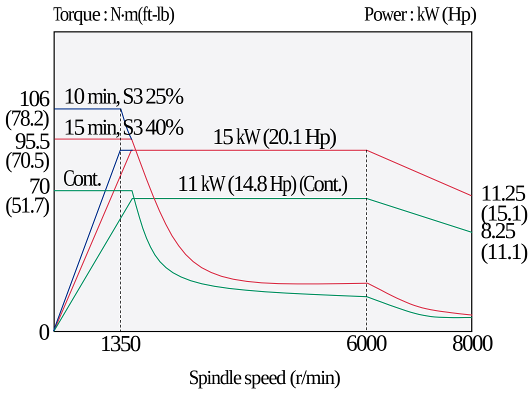
Oil skimmer

Spindle Power-Torque Diagram

DNM 400 Ⅱ / 500 Ⅱ

Max. Spindle Speed
8000 r/min

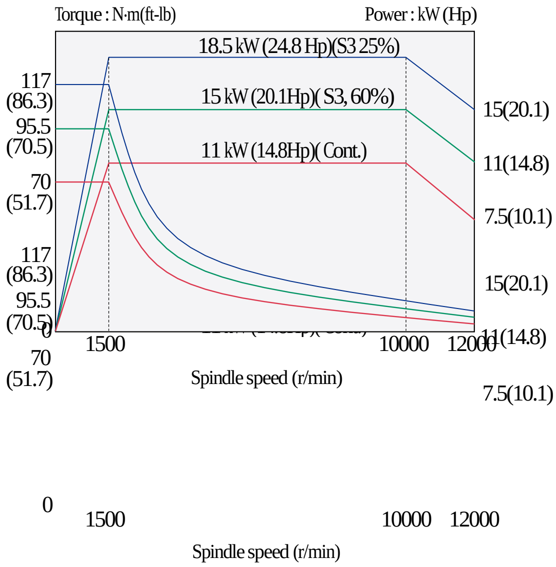
Max. Spindle Speed
15/11 kW
(20.1/14.8 Hp)



DNM 400 Ⅱ / 500 Ⅱ

Max. Spindle Speed
12000 r/min

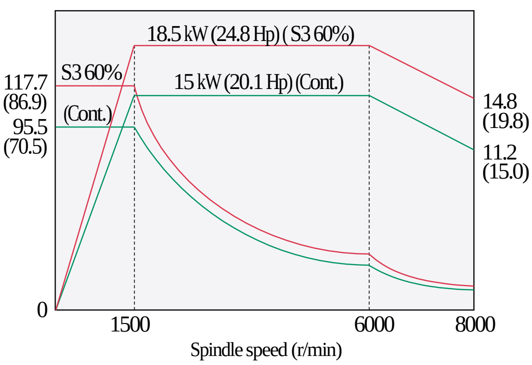
Max. Spindle Speed opt.
18.5/11 kW
(24.8/14.8 Hp)



DNM 650 Ⅱ

Max. Spindle Speed
8000 r/min

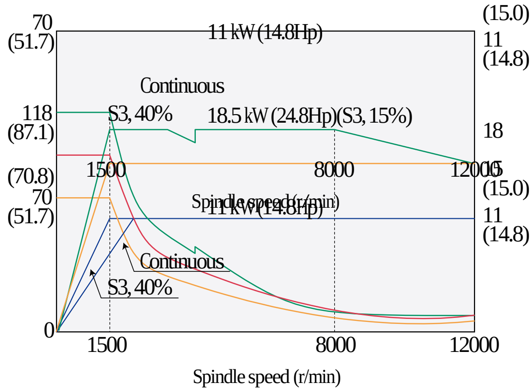
Max. Spindle Speed
18.5/15 kW
(24.8/20.1 Hp)



DNM 650 Ⅱ

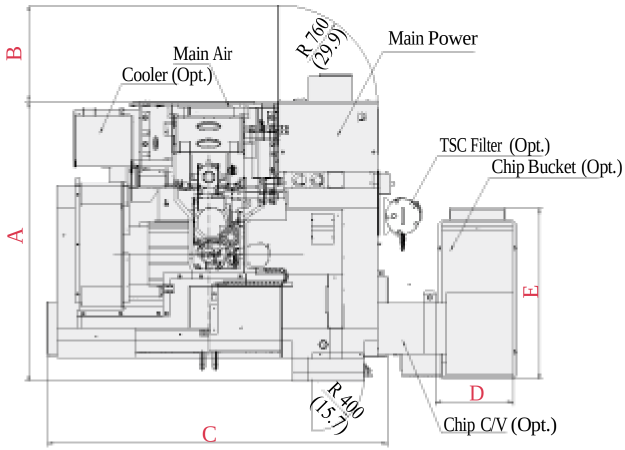
Max. Spindle Speed
12000 r/min

Max. Spindle Speed opt.
18.5/11 kW
(24.8/14.8 Hp)

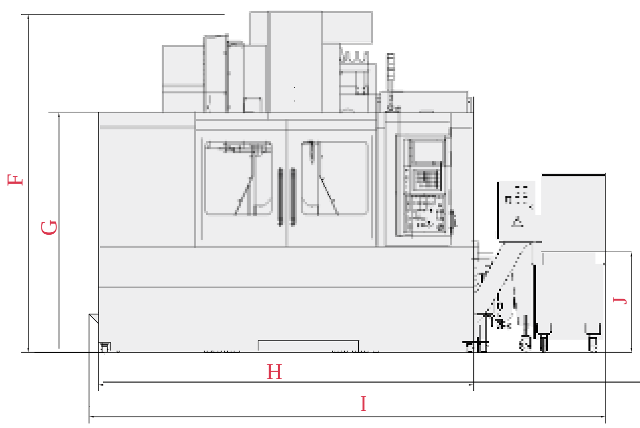


External Dimensions

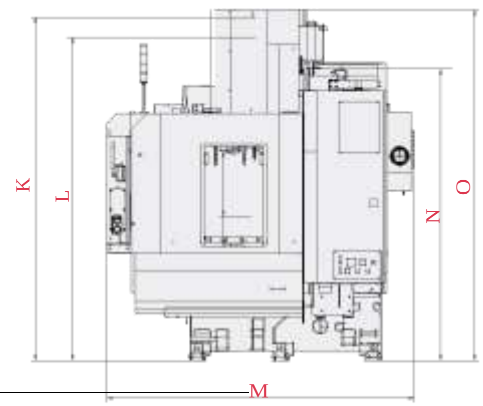
Top View



Front View



Side View

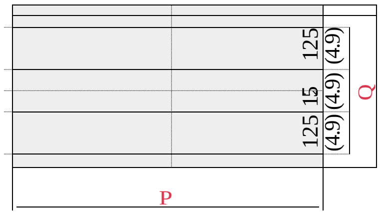


Unit : mm (inch)

	A	B	C	D	E	F	G	H	I	j	K	L	M	N	O
DNM 400 Ⅱ	2152 (84.7)	742 (29.2)	2615 (103.0)	594 (23.4)	1317 (51.9)	2711 (106.7)	1900 (74.8)	2465 (97.0)	3655 (143.9)	772 (30.4)	2676 (105.4) (40 Tools)	2509 (98.8) (30 tools)	2364 (93.1)	2245 (88.4)	2711 (106.7)
DNM 500 Ⅱ	2444 (96.2)	641 (25.2)	2960 (116.5)	594 (23.4)	1317 (51.9)	2700 (106.3)	1900 (74.8)	2960 (116.5)	4078 (160.6)	797 (31.4)	2674 (105.3) (40 Tools)	2509 (98.8) (30 tools)	2552 (100.5)	2425 (95.5)	2700 (106.3)
DNM 650 Ⅱ	2642 (104.0)	602 (23.7)	3350 (131.9)	594 (23.4)	1312 (51.7)	2815 (110.8)	1960 (77.2)	3200 (126.0)	4345 (171.1)	785 (30.9)	2789 (109.8) (40 Tools)	2624 (103.3) (30 Tools)	2720 (107.1)	2530 (99.6)	2815 (110.8)

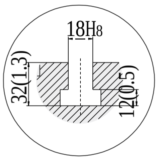
Table & Tool Shank

Table



Unit : mm (inch)

	P	Q
DNM 400 Ⅱ	920 (36.2)	435 (17.1)
DNM 500 Ⅱ	1200 (47.2)	540 (21.3)
DNM 650 Ⅱ	1300 (51.2)	670 (26.4)

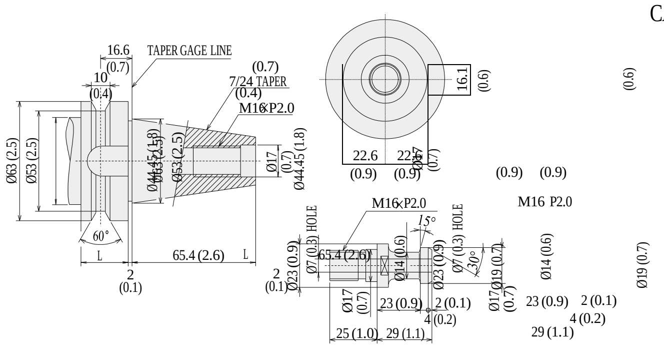


T-slot section

Tool Shank

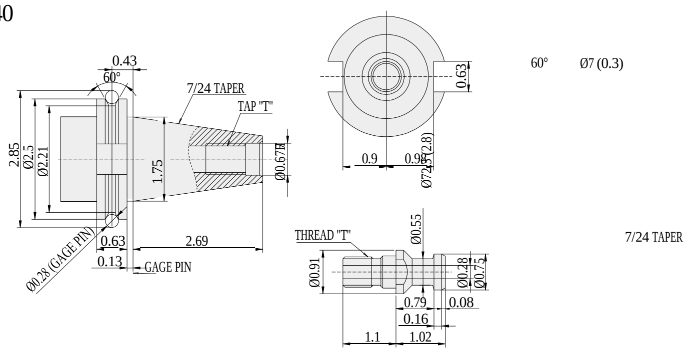
Unit : mm (inch)

BT40



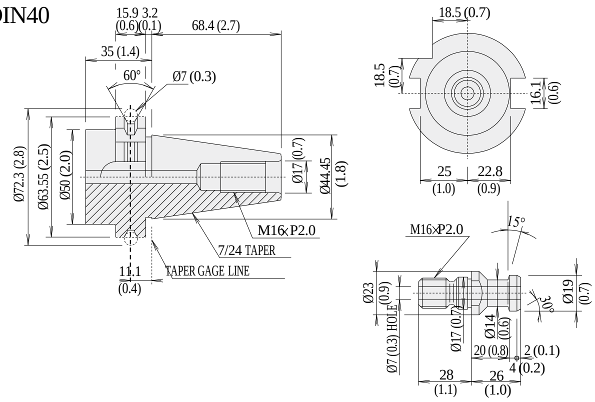
(DIN shape)

CAT40



(DIN shape)

DIN40



Machine Specifications

Features			Unit	DNM 400 II	DNM 500 II	DNM 650 II
Travels	Travel distance	X-axis	mm(inch)	762 (30.0)	1020 (40.2)	1270 (50.0)
		Y-axis	mm(inch)	435 (17.1)	540 (21.3)	670 (26.4)
		Z-axis	mm(inch)	510 (20.1)		625 (24.6)
	Distance from spindle nose to table top		mm(inch)	150-660 (5.9-30.5)		150-775 (5.9-30.5)
	Distance from spindle nose to column		mm(inch)	512 (20.2)	587 (23.1)	747 (29.4)
Feedrates	Rapid Traverse Rate	X-axis	m/min(ipm)	36 (1417.3)		
		Y-axis	m/min(ipm)	36 (1417.3)		
		Z-axis	m/min(ipm)	30 (1181.1)		
	Max. Cutting feedrate		m/min(ipm)	15000 (590.6)		
Table	Table size		mm(inch)	920*435 (36.2*17.1)	1200*540 (47.2*21.3)	1300*670 (51.2*26.4)
	Table loading capacity		kg(lb)	600 (1322.8)	800 (1763.7)	1000 (2204.6)
	Table surface type			4-125*18H8		5-125*18H8
Spindle	Max. Spindle speed		r/min	8000 {12000} {8000}		8000 {12000} {8000}
	Spindle taper			ISO #40, 7/24 TAPER		
	Max. Spindle torque		N·m(ft-lb)	106.9 {117} {210} (78.9 {86.3} {88.6})		118 {117} {210} (87.1 {86.3} {88.6})
Automatic Tool Changer	Type of took shank			BT {CAT, DIN}		
	Tool storage capa.		ea	30 {40}		
	Max. tool diameter	Continous	mm(inch)	Ø80 {Ø76} (Ø3.1 {Ø3.0})		
		Without Adjacent Tools	mm(inch)	Ø125 {Ø125} (Ø4.9 {Ø4.9})		
	Max. tool length		mm(inch)	300 (11.8)		
	Max. tool weight		kg(lb)	8 (17.6)		
	Tool selection			memory random		
	Tool change time (Tool-to-tool)		s	1.3		
	Tool change time (Chip-to-chip)		s	3.7		
Motors	Spindle motor power		kW(Hp)	15/11 {18.5/11,15/9} (20.1/14.8 {24.8/14.8, 20.1/12.1})		18.5/15 {18.5/11, 15/9} (24.8/20.1 {24.8/14.8, 20.1/12.1})
	Coolant pump motor power		kW(Hp)	0.4 (0.5)		
Power source	Electric power supply(rated capacity)		kVA	30		42.55
	Compressed air supply		Mpa(psi)	0.54 (78.3)		
Tank capacity	Coolant tank capacity		L(gal)	300 (79.3)	380 (100.4)	
	Lubrication tank capacity		L(gal)	1.4 (0.4)		
Machine Dimensions	Height		mm(inch)	2703 (106.4)		2815 (110.8)
	Length		mm(inch)	2282 (89.8)	2444 (96.2)	2762 (108.7)
	Width		mm(inch)	2615 (103.0)	2960 (116.5)	3350 (131.9)
	Weight		kg(lb)	5000 (11023.0)	6500 (14329.8)	8500 (18739.0)

{ }: Option Specification

Standard Feature

- 10.4" color TFT LCD
- Air tight splash guard
- Built-in screw chip conveyor
- Coolant system
- Coolant tank and chip pan
- Door interlock
- Machine condition indicator lamp (signal tower)
- Non-water miscible coolant filter
- Parts and tools for installation work
- Portable MPG
- Spindle head cooling system (Standard for 12000 r/min)
- Work light
- X, Y, Z Absolute pulse coder

Optional Feature

- 4-axes rotary table
- Auto measuring instrument
- Auto power cutoff system
- Auto workpiece length measuring device
- Cam type tool magazine (40 tools)
- Chip conveyor and chip bucket
- EZ Guide i
- Minimum Quantity Lubrication
- Oil skimmer
- Spindle head cooling system (Optional for 8000 r/min)
- Test bar
- Through-spindle coolant jet*

* Please consult with technical engineer if the density of coolant is higher than 10%, as this could affect the filtration function

NC Unit Specification

DOOSAN FANUC-i series

AXES CONTROL

- Controlled axes	3 (X,Y,Z)
- Simultaneously controllable axes	Positioning (G00) / Linear interpolation (G01) : 3 axes Circular interpolation (G02, G03) : 2 axes
- Absolute pulse coder	
- Backlash compensation	
- Follow up	
- Least command increment	0.001mm (0.0001 inch)
- Least input increment	0.001mm (0.0001 inch)
- Machine lock	all axes / Z axis
- Mirror image	Reverse axis movement (setting screen and M - function)
- Stored pitch error compensation	Pitch error offset compensation for each axis
- Stored stroke check 1	Overtravel controlled by software

INTERPOLATION & FEED FUNCTION

- 2nd reference point return	G30
- Circular interpolation	G02, G03
- Cylindrical interpolation	G07.1
- Dwell	G04
- Exact stop check	G09, G61(mode)
- Feed per minute	
- Feedrate override (10% increments)	0 - 200 %
- Helical interpolation	
- Jog override (10% increments)	0 - 200 %
- Linear interpolation	G01
- Manual handle feed	(1 unit)
- Manual handle feedrate	x1, x10, x100 (per pulse)
- Override cance	M48 / M49
- Positioning	G00
- Rapid traverse override	F0 (fine feed), 25 / 50/ 100 %
- Reference point return	G27, G28, G29
- Skip function	G31

SPINDLE & M-CODE FUNCTION

- M-code function	M3 digits
- Spindle orientation	
- Spindle serial output	
- Spindle speed command	S5 digits
- Spindle speed override (10% increments)	10 - 150 %

TOOL FUNCTION

- Cutter compensation C	G40, G41, G42
- Number of tool offsets	400 ea
- Tool length compensation	G43, G44, G49
- Tool life management	128 sets
- Tool number command	T2 digits
- Tool offset memory C	Geometry / Wear and Length / Radius offset memory
- Tool position offset	G45 - G48

PROGRAMMING & EDITING FUNCTION

- Absolute/Incremental programming	G90 / G91
- Auto. Coordinate system setting	
- Background editing	
- Canned cycle	G73, G74, G76, G80 - G89, G99
- Circular interpolation by radius programming	
- Custom macro B	
- Decimal point input	
- Extended part program editing	
- I/O interface	RS - 232C
- Inch/metric conversion	G20 / G21
- Label skip	
- Local / Machine coordinate system	G52 / G53
- Maximum commandable value	±99,999.999 mm (±9999.9999 inch)
- No. of Registered programs	400ea
- Optional block skip	
- Optional stop	M01
- Part program storage	640 m (2,100 ft) [256 kB]
- Pentium Board	
- Program number	O4 - digits
- Program protect	
- Program stop / end	M00 / M02, M30
- Rigid tapping	G84, G74
- Sub program	Up to 4 nesting
- Tape code	ISO / EIA Automatic discrimination
- Thread cutting	
- Work coordinate system	G54 - G59

Operation, Setting & Display, etc

- 3rd/ 4th reference return	10.4" color TFT LCD
- Additional work coordinate system	G54.1 P1 - 48 (48 pairs)
- AI APC (Advanced Preview Control)	20 block preview
- Alarm display	
- Alarm history display	
- Automatic corner override	G62
- Clock function	
- Coordinate rotation	G68, G69
- Cycle start/ Feed hold	
- Control axis detach	
- Display of PMC alarm message	Message display when PMC alarm occurred
- Dry run	
- Graphic display	Tool path drawing
- Help function	
- Loadmeter display	
- Look ahead control	G08
- MDI/ DISPLAY unit	10.4" Color TFT LCD, keyboard for data input (small), soft-keys
- Memory card interface	
- Operation functions	Tape / Memory/ MDI / Manual
- Operation history display	
- Optional angle chamfering / corner R	
- Polar coordinate command	G15 / G16
- Program restart	
- Programmable data input	Tool offset and work offset are entered by G10, G11
- Programmable mirror image	G50.1/ G51.1
- Run hour and part number display	
- Scaling	G50, G51
- Search function	Sequence NO./ Program NO.
- Self - diagnostic function	
- Servo setting screen	
- Single block	
- Single direction positioning	G60
- Stored stroke check 2	

OPTION SPECIFICATION

- Additional controlled axes	4 axes in total
- AICC (AI Contour Control) with Hardware	200 block preview
- Data server	1024 pairs
- Fast Ethernet function	G45 - G48

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